Indian fish and fishing

Francis Day

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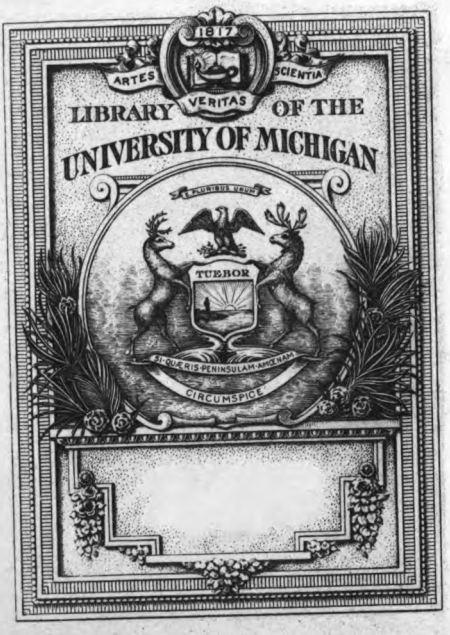

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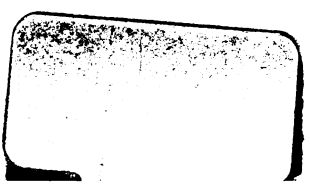

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International Fisheries Exhibition

LONDON, 1883

227

INDIAN FISH

AND

FISHING

BY

FRANCIS DAY, F.L.S.

COMMISSIONER FOR INDIA TO THE INTERNATIONAL FISHERIES EXHIBITION

ILLUSTRATED.

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INDIAN FISH AND FISHING.

ONE great purpose which many persons have anticipated from the International Fisheries Exhibition is a full investigation into the condition of fisheries in general; the causes which have conduced to their prosperity or deterioration, with the suggestion of rules for their future administration. At present British fish economists are divided into two schools, which may be thus defined:—

I. That Government should permit our marine fisheries to be untrammelled by legislative restrictions, everyone should be permitted to help himself to fish as he pleases under the belief that the stock in the sea is inexhaustible.

II. That Government regulations in the working of sea fisheries is advisable in order to prevent undue destruction of the spawn and young fish, on the supposition that our inshore fisheries, as well as those of some trawled forms, are being unduly depleted.

12-15-37 Mann

The following pages on the "Fisheries of India," mainly relate to the condition they were in a few years since as ascertained by personal investigations. Some of the obstacles under which they laboured have been removed, while others, it is hoped, are shortly to be remedied; but the result of the incidence of the salt-tax on marine fisheries, and the want of restrictions on fresh-water ones, are well demonstrated.

The length of the sea-board of India and Burmah has been

Mann.

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computed at about 4611 English miles, throughout the whole of which extent the waters are more abundantly stocked with fish than are those around the British Isles; either due to the greater reproductive powers of the species, or more probably to the less amount of depredation committed by man. While predaceous fish-consuming animals, as porpoises, sharks, rays, skates and sea perches, are far more numerous in the tropics than in these more northern climes. But it is a remarkable fact that due to some cause these fisheries which should afford a plentiful supply of food along the sea-coast are practically nearly unworked, except near large centres of population, or where cheap salt can be procured wherewith to cure the captures. This food harvest, up to within the last few years, has been comparatively untouched even while famines were devastating the contiguous shores.

Maritime fisheries, irrespective of affording food, ought likewise to be serviceable, as producing isinglass, fish oils and manures, as well as necessitating the purchase of materials for boat-building, the manufacture of nets, hooks and lines, the carriage of produce, &c. The principal modes made use of for utilising fish for food along the sea-coasts of India and Burmah may be considered under the following heads: (1) Fresh fish, how far it can be conveyed inland? (2) Dried fish and its varieties. (3) Cured or salted fish, and how prepared?

How far can fresh fish be conveyed inland? In examining this question, if the employment of ice or salt is omitted, the distance sea fish can be carried inland, while fresh, depends upon several circumstances. The season is one important factor, as during the hot months putrefaction commences very rapidly, while some forms, especially the immature, the herrings, and the siluroids or scaleless fishes,

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decompose more quickly than others ; and the same result follows close packing, or want of protection from the full force of the sun's rays. Usually, fish are not landed until after sunrise, while those brought on shore of an evening are generally kept where they are until the next morning, coolies being averse to travelling after dark. On the other hand, facilities of carriage may exist, as railways, water communications passing inland, or arrangements made for this purpose. As a general rule, inland places having no special facilities for carriage do not receive uncured sea fish in a wholesome condition upwards of ten miles from the beach where they were landed. Should, however, the fish be first opened and cleaned, some salt rubbed in, and care taken in their conveyance (as warding off the sun's rays), they may be carried considerably further. But salt being very expensive is very seldom employed for this purpose, or else a very slight amount is used, and putrefaction has often set in prior to the fish being disposed of for human food. While ice is only prepared or stored at large centres of population, and at such localities a ready market exists for all the fisherman's captures.

What varieties of dried fish exist in India? In many places along the shores of British India, especially where the salt-tax is rigorously enforced, it is usual for the purpose of laying in a store for future supply or for inland trade, simply to dry fish in the sun. This can be done with smaller and thinner forms, as *Ambassis*, *Equula*, the Bombay duck (*Harpodon nehereus*), many of the herrings and small varieties or immature forms, but not so well with the larger fish ; however, even from these last, slices may be cut and sun-dried. In some localities small fish are first buried in the sea-sand, in order to obtain a little saline substance, and subsequently sun-dried. In damp weather such articles

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rapidly decompose, while in the hot months they are attacked by innumerable insects.

Lastly, how are fish salted? The processes employed are chiefly divisible into the two following:—(1) Those cured with monopoly salt, or salt which has paid the Government tax; and (2) those prepared with salt-earth, or spontaneous and untaxed salt. I propose first referring to salt and its cost, for wherever the fisherman or fish-curer can obtain this condiment at a cheap rate, there marine fisheries flourish; where it is dear, his occupation is destroyed, except for the purpose of supplying daily wants, and a small surplus for salting or sun-drying. This will be most easily explained by referring to a few districts in detail.

The amount of salted and dried fish exported by sea from Indian ports was as follows (the value is given in £, computing one rupee at two shillings):—

Five Years ending	From Sind. Value in £.	From South Canara. Value in £.	From Malabar. Value in £.	From Coromandel Coast. Value in £.
1857–58	8,472	No returns.	No returns.	No returns.
1862–63	13,064	,,	26,272	,,
1867–68	18,725	6,969	48,207	1,753
1872–73	22,944	14,921	90,849	4,513

The duty in Sind upon salt was 2*s.*, or less, a maund of 82⅔ lb. avoirdupois, during the entire period comprised in the foregoing table.

The first great increase in salting fish in that province occurred in 1860–61, in which year the duty was raised in the contiguous Presidency of Bombay from 2*s.* to 2*s.* 6*d.* a maund. The next spurt of this trade, in Sind, was in 1864–65, when the salt-duty in Bombay was again raised from 2*s.* 6*d.* to 3*s.* a maund. Possibly the importations into

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that Presidency from Sind would subsequently have been even more considerable, but Government decided, in 1867, to admit all salt-fish from foreign ports, where no salt-duty exists, into British India free of duty, to the immense advantage of the Portuguese settlements and the Meckran coast, but completing the ruin of Indo-British fishermen and fish-curers, unless they were advantageously located.

In olden times, salt was allowed duty-free in British territory, for salting fish; but this enactment was repealed (year not ascertained), because the excise officers found that it assisted smuggling, and so necessitated keeping up a larger preventive staff than would otherwise be required.

The annual sales of Government or monopoly salt in the various districts on the Malabar coast of Madras, along with the value of the salted and dried fish exported by sea, are shown in the following table. The figures demonstrate that but very little, if indeed any, taxed salt was employed by the fish-curers; while in the native state of Cochin, the sale of salt in ten years, ending 1872–73, owing to augmented duty, was reduced by two-thirds, and it is a significant fact that it was during this very period the great increase in the amount of exported salt-fish began. In the contiguous British district of Chowghaut, although in the year 1872 £1067 8*s.* worth of salt-fish were exported, only £46 worth of monopoly salt was disposed of among the entire population.

The reason why the sale of taxed salt is not in proportion to the amount of salt-fish exported, appears capable of the following explanation. Due to a legal decision the people had become entitled to collect salt-earth in order to cure fish for their own consumption; but, there being no law restricting their disposing of any surplus they possessed, a large trade in selling salt-fish sprang up. This induced

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Years.	South Canara.		Cannanore.		Tellicherry.		Travancore and Cochin.	
	Fish. Value in £.	Salt Sold. Maunds.	Fish. Value in £.	Salt Sold. Maunds.	Fish. Value in £.	Salt Sold. Maunds.	Fish. Value in £.	Salt Sold. Maunds.
1863–1864 ..	1,057	191,002	96	11,653	1,459	72,505	5,416	728,268
1864–1865 ..	3,036	168,279	219	7,932	1,504	57,516	6,052	643,897
1865–1866 ..	875	184,174	11	9,856	194	62,135	7,061	672,370
1866–1867 ..	1,124	151,113	12	9,728	1,825	57,381	7,337	497,988
1867–1868 ..	875	174,629	303	8,721	2,011	56,502	7,803	558,766
1868–1869 ..	114	176,465	520	9,045	4,319	63,340	7,130	573,639
1869–1870 ..	2,053	147,173	4,340	8,807	5,839	72,616	6,096	574,119
1870–1871 ..	3,927	136,967	1,470	7,932	5,309	57,624	5,833	593,389
1871–1872 ..	2,845	177,482	695	12,008	5,340	88,674	6,987	577,268
1872–1873 ..	5,980	135,839	951	6,985	8,429	77,332	?	?

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an increased demand for fish; the fisherman's trade became well paid, and a very large amount of animal food found its way into the market which would otherwise have been lost. That this is most probably the correct explanation is shown by examining the condition of the fisheries on the eastern coast of the Madras Presidency at the same period. On this side of the Presidency the right to gather salt-earth was not recognised, but, observed one official, the practice of salting fish must be increasing, considering that the price of the fish, which formerly cost 2*s.*, has been reduced to 1*s.* 3*d.* or 1*s.* 6*d.* But it appears probable that this reduced value of the fish was due, not to the increased prosperity of the fishermen, who were evidently in a miserably poor state, but that the absence of salt wherewith to cure fish had diminished the demand for the article, and fishermen had to be content with a lessened price.*

In the Madras Presidency the salt-tax in 1859 stood at 2*s.* a maund, but has since been raised as follows:—1859–60, 2*s.* 9*d.*; 1860–61, 3*s.*; 1864–65, 3*s.* 4½*d.*; 1869–70, 4*s.*; 1875, 6*s.*; now 4*s.* The incidence of this tax resulted in a very small amount of salt-fish being prepared with monopoly or taxed salt for local consumption, and a little for export

* The Madras Revenue Board (May 14th, 1873) observed that the fishermen numbered throughout the Madras Presidency 394,735 persons; that the answers elicited by the questions put by Dr. Day, &c., have directed the attention of the Board to the subject of the influence of the salt-duties on the trade of fish-curing, and they see reason to think that a great practical hardship exists, which they would advocate immediate endeavours to alleviate. That this is being done will be shown by the following extract of a letter from one of the Members of the Revenue Board at Madras, who observed on November 8th, 1882, "The industry (of salting fish) is really commencing at last: 400 tons more were salted this year than last, and 80 more yards for curing are to be opened in a month or two." The amount cured in the Madras Presidency was 1734 tons in 1882.

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to Ceylon ; but the amount of this condiment employed by fish-curers cannot be great, as it makes no perceptible figure in the quantity of salt disposed of. During the last few years the system of bonded enclosures, within which fish may be cured with free salt, has been tried at Madras, and it appears to be working so successfully, that it is hoped it will be found practicable to introduce it to all other parts of British India.

In Bengal, excised salt appeared never to have been employed for fish-curing, and the fisheries were in a neglected state; or, as observed by the collector of Balasore, "Fish sold in the markets are so stale that no European would touch it, and most of it is putrid. . . . The people in this district do not salt their fish, they dry it in the sun, and eat it when it is quite putrid. They like it in this way, and there is no reason why they should be interfered with." Salt was then (1870) subject to a duty of ten shillings for 82$\frac{2}{7}$ lb. weight. Further to the eastward, in Burmah, the salt duty was one shilling for the same quantity, sun-dried fish a rarity, the fisherman's trade flourishing, while salted fish or crustacea, in the form of *nga pee*, invariably formed part of every meal among the indigenous population.

The amount of salt which must be employed in order to properly prepare a given quantity of fish is about as follows:—In Sind 20 lb. of monopoly salt is added to 82$\frac{2}{7}$ lb. of fish ; on the western coast of Madras, as Tellicherry, 28 lb. of salt is used to 82$\frac{2}{7}$ lb. of small fish, as mackerel, herrings, &c. It appears that, for the purposes of trade, one part of monopoly salt is necessary to about three parts of fish. However, at Gwadur, in Beloochistan, where this condiment is very cheap, a larger proportion of it was used than in either Sind or in India. Fish cured with salt-earth, or spontaneous but untaxed salt, require a much larger

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amount of this antiseptic than they do of monopoly salt, or nearly three (upwards of 2½) parts of salt earth to one part of fish. This cost of salt, it will be perceived, must have a direct bearing upon the usefulness of the fisheries; where it is cheapest (other things being equal) the fisherman's trade will be most developed. Along the coasts of Beloochistan, where there was no salt-tax (1873), large communities were entirely supported by fisheries, their captures being cured and exported for the Indian or Chinese markets. The same remark applied to the Portuguese settlements of Goa, Daumaun, and Diu, the salt used there costing about three-pence per 82⅔ lb. weight, whereas in the contiguous British territory it stood at the salt-pans at about four shillings. Hence the foreign fishermen were able to freely use this condiment; the cured article was preserved in a superior manner, more wholesome to the consumer, and able to be carried further inland.

The following return shows the amount of dried and salt fish (in maunds) despatched inland from Bombay and other stations on the Grand Trunk Peninsular Railway, for ten years ending 1881, and shows how the trade is developing :—

1872—21,837	Maunds.
1873—22,839	,,
1874—20,608	,,
1875—25,563	,,
1876—23,690	,,
1877—25,718	,,
1878—33,916	,,
1879—35,885	,,
1880—42,011	,,
1881—45,192	,,

A few years since, fisheries thrived along the Beloochistan coast and the Portuguese settlements, due to the excise on salt being not excessive or entirely absent. In

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the Bombay Presidency, the fisherman's market became restricted to the sales for immediate consumption, or else for sun-drying, or, as the Collector of Tanna observed, "Whether fish is dried as above, in preference to its being salted, is a question I have been unable to ascertain. It is very probable that it has been resorted to in the place of curing by salt, consequent on the excise duty levied on salt." Wherever salt-earth could be obtained free of duty, along the western coast of Madras, there the fisheries thrive, the fish-curer requiring a large supply of fish. Along the east coast of Madras, the collection of salt-earth was more or less prohibited, and the fisherman's trade, except near large towns, the reverse of flourishing. But in Bengal the fisheries are, or were, worst off, the only curing fish obtained being sun-drying. Lastly, in Burmah, where salt is cheap, the fisheries were thriving. Before concluding this portion of my subject, I would observe that it is not to be supposed that fish cured with salt-earth are of the best quality; on the contrary, it imparts a bitter and unpleasant flavour, and is believed to engender disease. But the poor cannot be particular respecting the taste or smell of their food—expense being usually the most important consideration. Salt-earth costs about $\frac{1}{2}d.$ a basket of 144 lb. weight, depending upon its quality; but, as I have remarked, it requires treble the amount to what is necessary if excised salt is used. But $82\frac{1}{7}$ lb. of monopoly salt was taxed $3s.\ 7\frac{1}{2}d.$ at this time; now $4s.$; whereas 246 lbs. of salt earth cost from $\frac{3}{4}d.$ to $1d.$, and this is evidently the reason of the latter being preferred by fish-curers for the purpose of preparing fish for the trade; for if monopoly salt, at its present rate, were used, the article, at least to the general public, would be beyond their means, and simply unpurchaseable. The reason why the plentiful harvest of fish in the sea remains ungathered

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is not due to the apathy of the fisherman, or the unwillingness of the general public to be consumers of fish, but is solely a result of the cost of salt, and that due to the Indian salt-tax, a condition of things which it is hoped is being slowly ameliorated.

Having thus briefly adverted to how the fisherman's and fish-curer's occupations are injured by the incidence of a heavy salt-tax, I pass on to the fishermen and their condition, as it was a few years since. Doubtless, should no sufficient market exist for the produce of their industry, some of these people must cease fishing, and engage in other pursuits; while those who remain to make a livelihood, as did their forefathers, seek the cheapest way and easiest method by which such may be accomplished. A very little acquaintance with the habits of fish suffices to teach the fisherman that the smallest kinds and fry are taken with the greatest ease; as, preferring the vicinity of the shore, and seeking their food in shallow waters, they are more readily captured in weirs, or with fixed engines and traps, than are the larger, more predaceous, and deep-sea forms. But by destroying or driving away the small fish, crustacea, and minute animal life, the food is being diminished which previously decoyed the larger and more predaceous forms in, thus scaring away what would otherwise be the natural supply. The fisherman's business is to supply personal requirements and family wants; consequently, if he obtains as much of the finny tribes as he can find a market for or otherwise employ, no injury is inflicted by his proceeding. For, so long as salt is not available for the purpose of curing any surplus, meeting the small local demand for fresh fish is all that is really requisite.

The deep-sea fishermen—or rather, those who ply their occupation outside the shallow waters of the littoral zone—

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as a rule do so by means of nets, stakes, or with hooks and lines. Deep-sea netting is not carried on to any great extent, partly because of the insufficiency of a market to render such remunerative, and likewise owing to the expense which would be necessary in obtaining the requisite nets, and the cost of building seaworthy boats. Fishermen are not to be classed among the richer classes, but have to borrow money, which is lent them at exorbitant rates of interest, wherewith to supply themselves with the requisites for their work. As an instance, in Sind a net suitable for sea-fishing would involve the outlay of £40 or £50, while it does not usually last more than a year. A boat costs about £100, and ought to be serviceable for several successive seasons. The money having been borrowed, the fisherman, who is the borrower, disposes of his captures at half the market rates to the money-lender, still this leaves a profit due to the existence of a good market for the fish-curer's trade.

Along the coasts of Sind large nets for sharks are employed in the comparatively deep sea; while off Malabar during the mackerel and sardine seasons, drift-nets, having a mesh suited to the size of the species it is desired to capture, are used for taking these two descriptions of fish, as well as for the seir fish (*Cybium*) and horse mackerel (*Caranx*), but not expressly for any other sorts. Also in the vicinity of large towns, or where a great demand exists, stake and other nets are somewhat largely employed. In some places fishing by hooks and lines is much pursued: not so in others. The modes of capture may be divided into two descriptions: *first*, the larger hooks used for sharks and other predaceous forms when they are connected by a chain to a strong cord; *secondly*, the smaller kinds of hooks used in catching sea perches, maigres, polynemi, and other

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eatable or valuable species. Occasionally artificial baits are also made use of. For embarking upon these last descriptions of fishing, a large capital is unnecessary, at least in such districts where catamarans or rafts are employed. When line fishing is carried on off coral reefs, as at the Andamans, large numbers of hooks are lost, due to the hooked fish dashing into or below the coral, when the lines become severed. In certain places, as at Kurrachee, for line fishing, moderately sized boats are employed, prawns being considered the most killing bait. In some boats captured fish are opened, cleaned and salted while at sea, and in others the whole of this process is carried out on shore. This is especially the case along the western coast of India, because the fisherman can obtain salt at Goa or other foreign settlements at $4\frac{1}{2}d.$ to $6d.$ a maund ($82\frac{2}{7}$ lb.), take it out to sea, capture and salt his fish there, and then run in and dispose of them at a British port.

The salt-water fisheries of India and Burmah are carried on by means of various contrivances from the most primitive to elaborate labyrinths; also in many other ways in the deep sea. Without entering upon a detailed description of each, with the variations noted in the several districts, perhaps it may be better to briefly advert to the chief characteristics observed.

First, there are tidal fisheries, the most primitive type of which is when pounds are constructed, or tidal ponds made use of, where the fish which enter with the flood are left impounded on the ebb occurring; from such a place they sometimes have to be removed by scoop, lavè, cast, or other nets; or a very rough stonework may be employed to bar the outlet to the fish, but through the interstices of which the water is able to escape. Bamboo, rattan, reed, or other screens constructed in various ways may also be used to

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preclude the escape of the imprisoned fish. Slightly in advance of these pounds, frequently constructed at the head of an estuary, are wicker-work labyrinths placed at right angles to the shore, or else acting like a pound in permitting the fish to enter with the flood, but precluding exit with the ebb.

Probably as the supply from pounds became insufficient, stake-nets were constructed where suitable currents exist, and these are now among the chief means of obtaining a supply of fish along some portions of the coasts of India. The stakes which are employed are usually made of the stem of some species of palm-tree or jungle wood, and up to as much as 100 feet in length. They are placed at right angles to the shore, and driven perpendicularly into the mud to a depth of twelve feet or more, and at a distance of about twenty-five feet apart, while to them nets, mostly constructed of hemp, and of a bag or funnel shape, are fixed. These bag-nets are up to great lengths, as forty yards, and are composed of meshes, diminishing from two inches between knot and knot, to half an inch at the apex. Into these nets the fish are carried by the tide or currents which exist even far out to sea, while fishermen are waiting to secure the captures. Trammels are also employed.

Another mode of sea-fishing is by means of a stationary dip-net; this in Malabar is worked from a frame-work situated upon the river-bank, where the tide ebbs and flows; an addition to this is used in China, where the dip-net is worked from a boat or a platform. Slightly in advance of these fixed nets are purse-nets, fixed in bamboo frames and capable of being dragged up narrow pieces of water, or lave-nets set in triangular frames, and which can be worked by a single man up shallows, or a row of fishermen can employ them along suitable places on the coast. Next we find the

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cast-net, which can be carried from one spot to another, as requirements dictate; occasionally several are joined together, thus constructing a drag-net. There are simple nets with floats, which are either without sinkers or with them; some employed near the shore have a bamboo at either end. There are purse-nets and bag-nets, some with, others without, pockets; some for drifting, others for being dragged or fixed; as well as special nets for various purposes, some of which have more complicated arrangements, while the size of the mesh is constructed in accordance with that of the fish it is intended to capture.

One of the most primitive forms of implement for the capture of fish, and which is extensively employed in the East, is cone or bell-shaped, made of pieces of split bamboo or rattan, the lower end of this cone being open, while at its upper end is a small orifice through which the fisherman can pass his hand and remove the captures. In many places rows of fishermen, each armed with one of these primitive implements, work a tideway, and often with good results, especially among grey mullet and small fish; or the upper end of this cone may be closed, forming a handle, while a rope-handle is affixed to the larger extremity, and it is thus employed as a scoop. A similar cone, but closed at its narrow end, and having a second one inserted into the larger extremity, when laid flat constitutes a trap which can be used in weirs or elsewhere. From these have sprung a most varied assortment of wicker traps, many resembling in structure rat-traps; some are baited, others simply inserted in tideways for the purpose of taking fish or crustacea. An enumeration of all forms would be endless. Triangular lave-nets used by a single fisherman are also constructed of split bamboo as well as of net.

In some places on the Andaman Islands, the fishermen

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to this day can obtain fish by diving, the use of spears, or shooting with bows and arrows; these latter having the shaft in two pieces attached together by a piece of string. The upper end of the shaft is made of reed which will float in the water, and as soon as the game is struck, the arrow separates into two parts (these being connected by string), and the fisherman obtains possession of the floating portion, and thus secures his prey. Hooks and lines are used in many places, and also artificial bait of the most primitive description in imitation of flying fishes (Plate IV., Fig. 3), and which is towed at the stern of boats when it is desired to take seir and other large fishes. In many parts crustacea are scarcely fished for, except as bait for line fishermen; in other localities, as Cochin, Madras, Calcutta, and Burmah, they are extensively captured. In taking crabs, an iron hook is inserted into the cavities of rocks where they exist, and by it they are removed.

The sea fishermen belong to the servile class or Sudras, according to the ancient legislators of Hindustan, and in most parts of the coasts of India still maintain that they were, in times now past, divided into two distinct classes—(1) those who captured fish in the deep sea, or beyond their own depth; and (2) others who fished from the shore and in the backwaters and creeks. But that now, owing to the depressed condition of the fishing trade, the deep-sea fishermen (except where salt is cheap or a good market exists) have taken to the less expensive occupation of plying their work in-shore, and earning a portion at least of their living by engaging in other pursuits. In several parts of India, more especially in the Madras Presidency, they have customs of a patriarchal nature, but which are more strictly observed on the Coromandel than on the western coast. In Sind the fishermen termed Mohanees are a

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Mussalman tribe, composed of immigrants from Arabia, or the descendants of Hindus possibly converted by their conquerors to Islam. The divisions are each under their own chief, who is hereditary, and his business is to settle caste disputes and other trifling matters, also to conduct the religious ceremonies connected with marriages and deaths. In Bombay, as in the Deccan and Carnatic, they claim to be a sub-division of the Mahrattas; while in the Madras Presidency, headmen to the fishing castes exist; in some localities they are hereditary, in others elective; or, should there be no headmen, matters are laid before certain wealthy individuals of their own caste, whose decision is final. In places where the fishermen are native Christians, the priest is frequently appealed to in order to settle such disputes as arise.

In olden times the fishing castes were commanded by their own chiefs, who appear to have been constantly ready to engage in military expeditions. The Samorin, in 1513, sent a deputation to Portugal, and his ambassador, who turned Christian, was knighted, under the name of "John of the Cross," by John III. On his return to Malabar, he was banished from the Samorin's court, as a renegade from the faith of his fathers. In 1532 he joined the fishermen, by whom he appears to have been installed as their chief, as he headed a deputation of eighty-five of them to Cochin, soliciting the assistance of the Portuguese against the Mahomedans. The whole of the embassy are said to have become converts to the truths of Christianity, so a Portuguese fleet was sent to their relief, and 20,000 are reputed to have immediately consented to be baptized. Ten years subsequently, Xavier instituted a church for these people.

It appears probable that the present organisation of the fishing classes is the remains of some ancient system, for

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on no other supposition can the existence of individuals holding such extensive sway be accounted for. The village or patriarchal system of an elective headman to such of his caste as inhabit each street and hamlet, is what is seen elsewhere among other classes; so likewise is the hereditary headman over several villages. But among the fishermen there exist priestly chiefs, two of whom in the Madras Presidency are to be found on the Eastern coast, one being at Madras and the other at Cuddalore, the territory of the former stretching up the Coromandel coast, while that of the latter reaches towards Cape Comorin. A third is found in South Canara, where he exercises spiritual control over a large district, and it is by no means improbable that others may exist. These chiefs, whose offices are hereditary, claim or receive fees and fines from those of their caste living within their jurisdiction, and they are the final referees in all cases of caste or family disputes.

The next grade is also hereditary. These mere petty chiefs or headmen only hold sway each over a few villages; their duties are the same, and some of their fees seem to have to be transmitted to their superior. On one of these headmen dying without heirs, a new one is elected by the people of the caste. Lastly, the fishermen have the elective headman, who is chosen by the residents of a single hamlet; his duties are to decide disputes, to be present at marriages and religious ceremonies, often to fix the work, and assist in certain Government duties; his emoluments appear to be very trifling.

Passing on to the condition of the fishermen (as it was a few years since) in Sind, they have to pay a tax of 10*s.* a ton yearly on their fishing boats, while the rate at which they borrow money for the purpose of procuring boats and nets I have already alluded to. Here these people are

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well off. At Guzerat, in Bombay, the fishermen are poor, and the precarious living they make often induces them to accept service as sailors, labourers, or anything that ensures them a steady competence. Although following out the condition of the fishermen in various districts must have rather a sameness, it will be necessary to do so in order to clearly see whether these people are really in a prosperous or in a poverty-stricken condition; whether, in short, it is the case that they are in the utmost misery, not due to their own laziness, but as a result of British legislation imposing prohibitory duties on salt. In the Junjura district, the fishermen supply themselves with boats and nets; six or ten club together to obtain a boat and net, dividing the produce; here they have decreased in numbers, at least, up to the year 1873 when my inquiries terminated. At Broach they are also said to have diminished. The same report comes from Kaira. In Rutnagiri the practice of salting fish has decreased during the last fifteen years, in consequence of the increase in the price of salt, but the fishermen are said to have increased. If, however, the practice of curing fish has decreased, while the number of fishermen has augmented, such must be due to a greater demand for fresh fish, or else the fishermen, from increased numbers, must be worse off than they previously were, or be engaged in other occupations as boatmen. However, the official from Kanara gives a similar reply. The Commissioner observed that at present no larger number of men are engaged on fisheries than are required to provide sufficient for local consumption. The practice of curing fish has to a great extent diminished, owing partly to the falling off in the amount usually captured, and also the duty charged on salt in British territory.

In the Madras Presidency, we are informed that, in the

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Tinnevelly Collectorate, the fishermen, as a rule, were a very miserable lot of people, and excessively poor. The way in which they work is by a system of advances made by traders, a few of whom reside in each fishing village, and supply all the requisites for fishing, as well as the boats, taking one-third of the captures as their share. In the Nellore district, although no one claims exclusive rights to the sea fisheries, the inhabitants of the different villages are exceedingly tenacious in order to prevent fishermen from other localities plying their occupation within what they believe to be their limits; this, however, is by no means restricted to this district, but is common throughout most portions of the sea-coast of India. In the South Canara district, where the use of spontaneous salt is, or rather was, not prohibited, the number of sea fishermen is stated to have increased of late years. This augmentation has been computed as high as 15 per cent. The same symptom of prosperity was reported all down the Malabar coast. At Ponany there is an annual increase in the number of fishermen. At Cannanore the owners of boats and nets supply them to these people, as well as advance certain sums of money. The money-lenders sell the captures, half the proceeds going to either party; if, however, the take is insignificant, the boat and net owners surrender their share to the fishermen. A like plan obtains at Tellicherry, where the fishermen have framed rules for their own guidance, one of which is the right of the first discoverer, among a lot fishing together, to a school of fish: he is allowed to capture them without hindrance from the others, even though at the time when the fish were discovered he was not prepared to launch his net. Passing out of the districts where the free collection of salt-earth is permitted, another change for the worse in

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the condition of the fishermen is reported. In Madura it is said that, on the whole, the sea fishermen have increased, but that the aboriginal fishing castes have decreased, owing to emigration or their becoming sailors. At Ootipadaram the native official estimates the daily earnings at threepence, taking all the year round, and excluding costs, and at Munjery at from three-halfpence to ninepence, while at Tenkarei their earnings are computed at from threepence to one shilling a day. In the Tanjore Collectorate, they are reported to have decreased in some places, but remained stationary in one locality. A little better report comes from Madras, but there the fishermen are also employed as boatmen, which is very profitable, while the vicinity of large stations affords a ready sale for fresh fish. Without tracing out the condition of these people in each district on the coast, it will be sufficient to say that they are poor and miserable, but not so badly off as in the Bengal maritime districts, where they appear to be quite poverty-stricken, unless near large towns. Passing on to Burmah with its cheap salt, we find the sea fishermen well off.

If we survey the reports from all the sea districts of India, we find the fishermen well off in Sind, while, unless in the vicinity of large towns, they are miserably off in the Bombay Presidency. Along the western coast of Madras, with its untaxed salt-earth, these people prosper ; but once round Cape Comorin, where the collection of spontaneous salt becomes a penal offence, they become, as observes the Collector of Tinnevelly, a very miserable lot of people, and such is the same account all up the Coromandel coast, except where there are large towns. With poverty we find them reported to be decreasing in numbers, due to cholera or other diseases, emigration, or accepting service as Lascars in coasting vessels. These are a people who in olden times

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were among the most prosperous of the inhabitants along the coasts of India; who, when the Portuguese first landed, were able to bring large armies into the field; whose occupation is now but too little considered by some of our Indian officials—as an European civilian remarked, that sympathy ought not to be wasted on fishermen, for they are an independent, careless, and drunken set of men. This gentleman appears to have placed upon official record what are probably the feelings of many who are unacquainted with the state of this trade, for by careless and independent is probably meant idle, which idleness is due, first, as I have already explained, to the incidence of the salt-tax; and, secondly, that when salt is unobtainable, did they exert themselves, the market would become overstocked.

The result of the investigations I conducted in India led me to conclude that wherever a good local demand existed for fish, the fishermen were in a prosperous condition. Wherever salt was dear, the fish-curers' trade was restricted or destroyed, and as a result the fishermen were in a depressed state. That fish salted with taxed or monopoly salt is a luxury for the rich, the sick, and for export: that such as is prepared with salt-earth keeps badly, and predisposes to disease. That in many localities where the salt-laws were rigidly enforced, the poor had to consume their fish putrid, or simply immerse it in sea-water, and then dry it in the sun. In short, it was patent to most that the depressed condition of the fishermen and fish-curers' trades was to be found in the incidence of the salt-tax, and that those who deprecate any interference with the poor fishermen, on the ground of their miserable state of destitution, must be unaware of their real condition. One cannot suppose such advisers to be oblivious of the distresses of those among whom they reside, or would desire

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to feed the poor on putrid fish, on the consideration that the realisation of the salt-revenue is of much greater importance than the lives, health, and comfort of their fellow-creatures. Assisting fishermen with money, boats, and nets would be insufficient to place the sea-fishermen and fish-curers' trade in a healthy state, while if it is in a healthy condition such advances are unnecessary. Expensive salt is beyond the reach of the majority of the fish-curers, it is ruinous to their trade, and in the ruin of the fish-curer the fishermen must eventually participate. It is to be hoped that the endeavours now being made to re-introduce prosperity among this numerous class will be productive of the greatest benefits, not only to themselves, but by augmenting the food for the general public.

Fresh-water fisheries differ in many respects from marine ones; while, wherever any quantity of fresh water exists in the East, there we are almost certain to find fish; and this from a sea level to nearly the summit of the highest mountains. Consequently, fishing is had recourse to, in various manners, in rivers, irrigation canals, lakes, tanks, ditches, inundated fields, and swamps. The importance of such fisheries is not solely in a ratio as regards their productiveness, but also in accordance with the character of the adjacent people as to whether they are or are not fish consumers; while the sparsity or the reverse of the population has also to be taken into account.

Should no regulations be in force for the protection of inland fisheries, and other circumstances be equal, that district which is most densely populated by man will be least so by fish. Individuals can more readily live by fishing than by agriculture, as the trouble of capturing the finny tribes is considerably less than that of tilling the soil. But unregulated capture is simply catching food without a

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thought respecting future supply. Fish have been endowed with certain means of increase and protection—the number of their eggs may be enormous, and sufficient to counterbalance natural waste. The operations of man, however, are in excess of natural waste, consequently such a destructive agency requires to be kept in some check. In India certain forms of fish keep guard over their eggs, and likewise over their fry, in order to afford them protection from their enemies.

When man increases, watery wastes (wherein the fish had been protected by grass, reeds, bushes, and the roots of trees) become drained and cultivated; predaceous man increases his means of destruction; an augmented population, possibly assisted by the unscrupulous manufacturer or miner, pollute the previously wholesome water, and a diminution of the finny tribe becomes apparent to the investigator.

With an increasing fish-eating population, an increased supply of fish is a self-evident necessity, and this must be provided for by augmented captures or dearer prices, the latter acting as a check on the poor, by more or less placing it out of their reach. This latter result may, consequently, eventuate in gradually diminishing the physical strength of the people by decreasing their food, a proceeding which will scarcely bear examination. It is clear that a greater supply must be met from one or two sources, either from fisheries which previously have been insufficiently worked, or by overworking such as exist, by means of capturing, for present use, those which ought to be left for a future season. Even if the extent of the water is so great, and the contiguous inhabitants so few, that this result need not be anticipated for several generations, still, populations under good systems of government have a natural tendency to

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increase. Means of carriage generally improve with time, and should neither regulation nor care of the fisheries be attempted, disastrous results must eventually be arrived at, unless the finny tribes by means of artificial propagation are kept up to the required numbers. Fish appear to have but few friends but many enemies, and investigations as to their condition but too frequently end in giving increased licence to their captors. We see interested parties and philanthropists (so-called) exclaiming against the hardship to the poor in not allowing every available fish to be secured. The majority of our law-makers are content to allow the fish to shift for themselves, and to leave the fishermen to be controlled simply by their own consciences. To-day's market it is hoped will be supplied, sufficient for this season it is believed may be obtained, so to-morrow's wants are left to be met as they can, until the time arrives when depletion of fisheries becomes obvious, when, if the fault cannot be laid upon meteorological or other conditions, something has to be attempted.

The fishermen of the fresh waters of India and Burmah are divisible into two main classes—first, such as follow this calling as their sole means of livelihood; and, secondly, such as engage in it only occasionally, and as a subsidiary occupation. Who, then, are these Indian fishermen? Here, even within the limits of a single, or at least of a few generations, great innovations have crept in, for in the time of native rule, fishing was in the hands of distinct castes, but now it is only here and there that one comes across some remnants of these people, living in small communities, and frequently in the greatest poverty. At Combaconum, in Madras, there is a tradition that the fishing castes resident there were originally brought from Conjaveram as palanqueen-bearers; while, at Broach, in Bombay,

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two sub-divisions of these people are named in accordance with the villages from which they originally migrated.

In native States, fish have obtained great consideration, more so perhaps in ancient than in our own times. Thus in Mysore, in the time of Hyder Ali, very stringent fishery laws existed; whereas, at the present day, about two-thirds of the population of some divisions of the country occasionally add fishing to their other occupations, nearly every villager possessing a fish-net or trap, to be employed as occasion or opportunity arises. Now fisheries are open to all; a fisherman's calling is no longer a profitable one, mainly due to the fisheries being depopulated. When whole districts were let to contractors, they were not so short-sighted as to permit an indiscriminate destruction; but now everybody does as he likes, when he likes, where he likes, and how he likes. Thus it has come to pass that among the animal productions of India, fresh-water fish meet with the least sympathy, and the greatest persecution, many forms having to struggle for bare existence in rivers which periodically diminish to small streams, or even become a mere succession of pools, or in tanks from which the water totally disappears. They have their enemies in the egg stage, in their youth, and during their maturity; but among these man is their gretest foe, as anyone who desires a fish diet captures these creatures whenever and wherever he gets the chance, irrespective of season, age, and size. In certain districts they simply appear to exist solely because man and vermin have been unable to destroy them.

Fisheries may be let to a contractor, and if their extent is large he takes partners or sublets portions; sometimes he employs servants, who are paid partly in money, or food, clothing, and lodging, and partly in a share of the captures. In some districts the fisheries, or a portion of them, are

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declared free, but a licence fee is charged to the fishermen. Or the general public is permitted to take fish for home consumption, but not for sale. Lastly, no regulations at all may exist, due to the general poverty of the fisheries, peculiar difficulties in their capture, or the general impecuniosity of the inhabitants.

When the public have, more or less, depleted fisheries, the fishermen become poorer and poorer, unless they turn to other sources of obtaining money; at first, no doubt pleased at the remission of rents, and the removal of all restrictions upon fishing, they employ redoubled energy, and thus augment their immediate profits. But soon the general public find that nothing precluded their fishing in any way they please; the markets become glutted, and the price may fall from the want of purchasers. But after two or three years fish become scarcer; fishing is no longer remunerative; removing the rents from fisheries and throwing them open to the public will not decrease the price of fish. The rates ruling in India are comparative to what obtains for meat and other articles of animal food. Fishermen, living on free fisheries, do not dispose of their captures below market rate any more than farmers who possess rent-free farms sell the produce at less than their neighbours, while perhaps one of the widest spread fallacies of the present day is, that permitting fisheries to be free of rent and unrestricted by regulations, is beneficial to the fishing population. If the fisherman benefits, the purchaser does not, and their misapplied energy eventuates in nothing but small fish remaining. The young have to be raised from ova of such as are merely one or two seasons old, while the younger the parent the smaller the eggs, and this is probably one mode in which races of fish deteriorate.

The rivers which have Alpine sources, as such which

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descend from the Himalayas, have, exclusive of springs, two most abundant sources of replenishment. During the hot months this is derived from melted ice and snow, while during the monsoons the rains assist; we may then have the hill rivers forming torrents, rising rapidly, and as rapidly subsiding, while they possess no contiguous tanks into which the fish can retire. These animals are often peculiar, or endowed with means of existence differing from such as live wholly or mostly in the waters of the plains. Many of the fish are provided with adhesive suckers, situated behind the lower jaw, or placed on the chest, which enable them to fix themselves against rocks, and so prevent their being washed away by the stream.

Through the cold months, and generally until the setting-in of the south-west monsoon in June, rivers are at their lowest, some at this period (especially in hilly regions) being merely a succession of pools, united by a more or less insignificant stream, in which limited localities the fish take refuge, and may be easily secured by fishermen.

Among the artificial causes affecting fisheries in many districts are the irrigation works, which are formed by throwing a weir or bund across a river, and diverting a large amount of its water down a main irrigation canal. These weirs are usually built as stone walls across the entire breadth of rivers, and consequently impede both the upward and downward passage of fish that are endeavouring to migrate, while should they be sufficiently high, they entirely stop them. Where large under-sluices are present, fish can pass up such when open; but up the long narrow ones, as constructed in Madras, the strength of the current renders this impossible. The under-sluices are here closed, except where there is an excess of water, as during the monsoon months; and as the weirs have no fish-passes, not only is ascent towards the

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breeding-grounds intercepted, but fishermen take the opportunity of capturing the fishes which are detained here. Standing on those weirs, one can see the fish jumping against the obstruction, which they vainly hope to surmount; some strike against the piers of the bridge, others fall into the cascade which descends over its summit; but to them the wall is an impassable obstacle.

The irrigation canals may be said to be streams obtained by diverting a large amount of water from a river into a new channel, and this, of course, would be taken from above the weir; consequently, all fish descending the river become diverted into the irrigation canal. If these canals are constructed for navigation as well as for irrigation, the fish can pass along them; but if due to falls, they are unsuited to navigation, then the fish can descend them, but are unable to re-ascend. They thus become vast fish traps, wherein all the finny inhabitants are destroyed whenever the canals are run dry in order to examine their condition in order to see what annual repairs are necessary. Passing off on either side of these canals are lateral irrigation channels, which are employed to directly water the crops, and at each successive replenishment of these, another shoal of fish passes to inevitable destruction. Unprovided with gratings at their entrance, and only kept filled on alternate weeks, all the fish which enter invariably perish. The same destructive process exists throughout India wherever irrigation is carried on.

As the yearly rains cause inundations of the country by the overflowing of the rivers and tanks, fish move about in order to find suitable localities for breeding in, and the small streams and their outlets resemble the net-work of irrigation channels. Many species ascend them to spawn, but find, at every turn, appliances invented by man ready for their

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destruction. Persons may be watching to intercept them, engines or traps may be fixed in their course; or, should any breeding fish succeed in effecting their ascent, means are taken to ensnare them on their return, whilst the fry are destroyed in enormous quantities—a proceeding which has been declared not to be waste because they are eaten.

Then there are tanks, some of which are, others are not, in connection with running water. Should they entirely dry up during the hot months, only such fish as bury themselves in the mud will survive to the next rainy season. As a rule, the owner of a tank, if it is employed also for fish-culture, leaves one portion (the deepest) in order to retain sufficient water to keep the finny residents alive, while, during the hottest weather, boughs of trees or tatties are placed over this locality to mitigate the heat.

The fishes which inhabit the fresh waters of India, Burmah, and Ceylon, may be divided into (1) those which enter from the sea for breeding or predaceous purposes; and (2) such as, more or less, pass their lives without descending to the salt water.

An exhaustive account into the strictly fresh-water forms would doubtless be interesting scientifically, but hardly so to the fisherman or general reader; consequently I shall restrict myself to observing that the fisheries alluded to contain about 369 species, appertaining to eighty-seven genera. Of the spiny-rayed, or *Acanthopterygian* order, we have nineteen genera, the members of which are most numerous in the maritime districts and deltas of large rivers, while their numbers decrease as we proceed further inland. Few are of much economic importance, if we except the common goby, spine-eels (*Mastacembelidæ*), the snake-headed walking fishes (*Ophiocephalidæ*), and the labyrinthiform climbing-perch and its allies. Among these forms,

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the semi-amphibious walking fishes deserve especial notice, owing to their great economic importance. When pollutions or poisonous substances find access to rivers, or mud is carried down in such quantities as to choke the gills of most forms, these Ophiocephalidæ are almost unaffected, for breathing atmospheric air direct, the presence or absence of fluviatile contamination is not of such material consequence to their existence. They are able to live until the poison has passed down-stream and the waters are again purified. Of the sheat-fish, or scaleless siluroids, we have twenty-six genera; the mouths of these forms are provided with sensitive feelers, which, serving as organs of touch, assist them while seeking their prey in turbid waters. All that are of sufficient size are esteemed as food, although, owing to their propensity for consuming unsavory substances, their wholesomeness appears, at times, to be questionable. The next three genera, gar-pike (*Belone*), Cyprinodon, and Haplochilus, are of but little value, but the thirty-five genera of carps and loaches are of the greatest possible consequence, affording a large amount of food to the population of the country. The remaining four genera, consisting of the curiously flattened *Notopterus*, and three forms of eels, are of but little mercantile importance.

The various modes in which the reproduction of these fishes is carried on is a most necessary investigation, and in briefly considering such, we must inquire into what migrations they undertake for this purpose? Whether the parents are monogamous, polygamous, or are annuals dying after the reproductive process has been accomplished? The time of year when spawning occurs? Whether such is or is not deleterious to the parent? The size of the eggs, their colour; whether they float or sink; are deposited in

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running or stagnant waters? If they are covered or left uncovered in their nests? If the male carries them about or protects them? Can their germination be retarded by artificial means or natural causes, as by the action of cold or their immersion in mud?

That anadromous forms, as the salmon or shad of Europe or the hilsa (*Clupea palasah*) of India, pass from the sea to the fresh waters to deposit their eggs in localities most suitable for their reception, is well known. If we examine into the migration of Indian fishes for breeding purposes in fresh waters, we find such takes place under three conditions, viz. :—(1) anadromous forms from the sea to the fresh waters, as already adverted to; (2) such species as may be considered pertaining to the mountains, or else deposit their ova in the rivers of the hills; (3) such as are restricted to the plains, but which likewise undertake certain changes of locality at these periods. Of the migratory hill fishes, the various forms of large barbels, *Barbus*, termed *Mahaseers*, furnish good examples. In the Himalayas they ascend the main rivers, but turn into the side streams to breed; while on the less elevated Neilgherry mountains in the Madras Presidency, the same phenomenon occurs, but with this difference, that they deposit their ova in the main streams because such are small, and perhaps due to their never being replenished with snow-water. Occasionally the fish are too large to ascend these mountain rivers, when they would appear to breed at the bases of the hills; whether it is from the offspring of such that this genus has extended through the plains it is not my purpose to inquire in this place. When the rivers commence being in flood, adults are able to ascend to feeding grounds which were previously inaccessible to them. Having spawned, they keep dropping gently down stream, during which time the amount of water is diminish-

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ing; thus the ova, when hatched, are completely cut off from the locality where their parents reside, precluding the possibility of their devouring them. The fry, consequently, have the heads of the rivers to themselves in perfect security, and each torrent becomes transformed into a small stream intersected by pools, where they can remain until the next rains enable them to descend to the larger rivers. Of the migratory fishes of the plains, we may observe many forms of carp, and this is more particularly perceptible where impassable weirs exist across the rivers; here they may be perceived attempting to jump over the obstruction, and so common is this phenomenon that the natives of India hang baskets, cloths, even native cots turned upside down, or anything equally suitable, over the sides of the piers, and into this the fish fall.

In Asiatic waters we have monogamous and polygamous forms of fish and other phenomena as to breeding, which deserve attention. The walking, or snake-headed fishes, *Ophiocephalidæ*, of India, and other amphibious genera, are perhaps the best known of monogamous fishes; some of them reside in ponds, others prefer rivers, where they take up their residence in deserted holes, which they find in the banks. The pond species delight in lying at the grassy margins, where the water is not deep enough to cover them; and here they are able to respire atmospheric air direct. The striped walking-fish constructs a nest with its tail among the vegetation, and bites off the ends of the water weeds; here the ova are deposited, the male keeping guard; but should he be killed or captured, the vacant post is filled by his partner. The hissar, *Callichthys*, of South America, is likewise monogamous, constructing a nest which it also defends. The majority of fishes unquestionably are polygamous, as has been repeatedly observed, and

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perhaps as distinctly among the salmon as any other form in a wild state, and likewise in sticklebacks resident in aquaria; while, doubtless, fishes which migrate in shoals for breeding purposes, as the mackerel, herrings, or some forms of carp, are all polygamous.

The time of year at which spawning is effected varies in accordance with the locality and the family of fish. This again appears to be further susceptible of modifications in accordance with the temperature of the water, and many other local causes, while there are some fishes which only breed once a year, others more frequently. I must here premise that some fishes do not appear to feed during the season of depositing their spawn, as the salmon, the shad, and the siluroid *Ariinæ*. In India an anadromous shad termed "Pulla" in the Indus, "Ulum" by the Tamils, "Sable-fish" by the Madrassees, "Palasah" by the Telingis, "Hilsa" or "ilisha" in Bengal, "Nga-tha-louk" by the Burmese, breeds in rivers as already described. In Sind they ascend the Indus in February to spawn, descending in September. In the Cauvery, in Madras, they pass up when the first burst of the June monsoon fills the river, and continue doing so for the succeeding four months. In the Kistna, which has a far greater velocity, but, similarly to the Cauvery, is filled in June, they defer their ascent until September, but it is not until the end of the month, or commencement of October, when the waters are subsiding, and their velocity decreasing, that the majority arrive; whereas in the neighbouring river, the Godavery, in which the current is less rapid, these fishes ascend earlier to spawn, being most numerous from July to September. In the Hooghly they continue ascending throughout the June monsoon, and many are found still in roe in September. The main bodies of these fish ascend the large rivers of India and

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Burmah generally when the June monsoon commences, but not always at the same period, such apparently at times being dependent upon the rapidity of the current and other causes. That it is not solely due to the presence of rain-water flooding the river is evident, because those of the Indus and Irrawaddi are mainly caused by melting snows at this period, and likewise in the latter river these fishes push on to Upper Burmah, to which country the monsoon scarcely extends, but where the inundations are due to snow floods. Probably the cause of the majority of fishes at these various periods ascending the different rivers to spawn may be due to their having been bred there, while inherited instinct causes them to select the most suitable times, when the shallows are covered with water, and ascent is rendered practicable.

It is evident that members of the same family, genus, or even species, may spawn at very different periods, due to local or climatic causes. There are also fishes which deposit their ova twice yearly, if not more frequently; these are generally fresh-water forms, and not rare, especially in tropical countries; as an example, we have the walking-fishes.

Whether spawning exercises any deleterious effect upon the parent fishes, two replies may be given, as in some cases it renders their flesh unwholesome, while in others it does not cause their character as to food to be much altered. The shad in the East are excellent eating up to the period when they have deposited their eggs, subsequent to which they become thin, flabby, and positively unwholesome. Fresh-water fishes that deposit a smaller number of eggs, or perhaps do so more gradually, or twice at least during the year, do not invariably appear to be so deleteriously affected by breeding.

The size of the eggs, their colour, and whether deposited

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in fresh waters or in the sea, are all questions requiring attention. The forms which produce the greatest number of eggs are often those which live in large communities and spawn once a year. In an Indian shad I found 1,023,645 eggs. But other fishes have likewise numerous eggs. I observed 410,500 in a barbel (*Barbus sarana*) ; on the other hand, some have large eggs, as a few of the sheat fishes, and a genus of carps (*Barilius*). In such as spawn at least twice a year, and likewise protect their young, the number of eggs is less than what generally obtains in other genera ; thus in a walking-fish (*Ophiocephalus*), I found 4700.

Respecting the colour of fish eggs, they are very diversified ; in some fresh-water siluroids they are of a light pea-green, as in the scorpion fish, *Saccobranchus fossilis*. Regarding the localities where fish deposit their eggs, these are exceedingly various, as might be anticipated, owing to some sinking in the water, while others float. The gar-fish (*Belone*), and the flying-fish (*Exocœtus*), have filaments springing from their eggs for the purpose of attachment to contiguous objects ; others are covered with a glutinous secretion. In fresh waters eggs may remain at the bottom, either covered or uncovered.

Among the marine siluroids (*Ariinæ*), in some forms the male carries about the large eggs in his mouth until hatched ; or it may be that he only removes them from one spot to another to avoid some impending danger. However this may be, I have netted many along the sea-coast with from 10 to 20 eggs in their mouths, and in one example was a young fry just hatched. In none of these large males was there a trace of any food in their stomachs.

Bloch, at the end of the last century, made many experiments as to the feasibility of fish being artificially hatched, and also whether it could be possible to convey the ova

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in safety for any considerable distance. He proposed placing the eggs of pond-fish in mud, similar to that existing in the locality from whence the eggs were procured, and he believed that when the mass had dried, they could be thus removed without injury, from one pond to another. His proposal was based upon the theory that frequently on dried-up ponds being refilled with water, young fish appear, and which could only be due to the eggs having been present in the mud, but with their germination suspended. In India, as ponds dry up, some of the fish contained therein descend into the mud, where they æstivate until the next year's rains set in. As these commence, and the mud liquefies, fish are perceived diverging in all directions, up every watercourse, no matter how small, or how lately it may have been dry, while in a few days fry are distributed everywhere. Where the eggs come from which have produced these fry is a very interesting subject for investigation. Have they remained inside the mother fish, and did she deposit them as soon as the rains set her free? I cannot accept this theory, because I have witnessed fish removed alive from the mud, but they had no ova; and secondly, because the fry are so soon hatched after the setting in of the rains, while none of these fish are ovi-viviparous. It seems more reasonable to suppose that the fertilised eggs are embedded in the mud, and, as soon as the rains occur, they become hatched out, and this would give us reason for attempting to ascertain whether ova of pond fishes imbedded in mud could be successfully transported long distances.

We know that germination of fish eggs can be retarded by cold. In fact, by the use of ice, those of trout and salmon have been safely conveyed to Tasmania and elsewhere, and from America and Canada to Europe.

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From the information collected between 1869 and 1873, it appeared that the fisheries in our Indian Empire in olden times were royalties, mostly let out to contractors, who alone in their respective districts possessed the right to sell fish, while they, as a rule, permitted the people, on payment, to capture sufficient for their households. It was, in fact, a licence on payment, resumable at will. Remains of this custom still exist in Lahore, while the leasing of fisheries is even now in force in many portions of India. Along the Himalayas, in the Kangra and other districts, the petty rajahs adopted a different method. To some persons they gave licences to supply the fish markets, of which they virtually made them monopolists, while others obtained licences for fishing with small nets for home consumption, but not for sale. In Burmah, under native rule, a similar plan was carried out. There were no free fisheries; but inhabitants had the privilege—or perhaps right—to fish for home consumption on the payment of a fixed annual sum to the contractor for the district in which they resided. It is believed, under native rule, the erection of fishing weirs was permitted in several of the streams in the Himalayas, but not to the extent that they are at the present day. In some districts landowners even now raise an income from the fisheries, claiming a third of the captures or a certain amount of money. Some of cur officials consider that, as Government has permitted indiscriminate fishing, the exercise of long practice has converted such into a communal right.

As British rule has gradually superseded that of the native princes, so the modes in which fisheries were leased has become widely different, and in permanently settled estates, unless a stipulation to the contrary exists, they go with the land. In some localities it has been decided that

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the adjacent villagers or people possess certain communal rights with respect to them, due, it seems most probably, to a misapprehension. Although it may have been proved that the landowner never received more than one-third of the produce, this does not demonstrate that the other two-thirds were public property, but that such expressed the share accruing to the fisherman in return for his labour in capturing the fish. It is the rule in India and Burmah to remunerate by the proceeds—sometimes the working fisherman has to dispose of his share to the contractor or lessee at a given rate; more rarely the fish are sold, and he receives a proportion of the returns, or he may be paid in kind. In the manual of the Madura district, it is remarked that a letter of 1713 states that the fishery of a single tank produced occasionally as much as 2000 crowns; and that sums so realised were invariably applied to the execution of repairs. In some localities the British Government leased fisheries, or imposed a tax on the implements of fishing, or a capitation tax upon the fishermen, but without interfering with the manner in which the fisheries were conducted. By degrees the tax on fishing implements was taken off, but the fishermen still became poorer, and in 1849, at least in Madras, many leased fisheries were thrown open to the public, resulting, as they were not regulated, in unlimited licence, and thus an intended boon eventuated in their depopulation. In Burmah, the practice of employing fixed engines in irrigated fields and watercourses very largely increased when the native *régime* became abolished, as did also the custom of throwing weirs across creeks and minor streams.

Free fisheries have been permitted, due to several causes, such as the difficulty in making them sufficiently remunerative to bear taxation or the incidence of rent; this may be

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owing to the rapidity of the current, the paucity of fish as in some hill streams and depopulated rivers, the depths of tanks, the presence of foreign substances in them, or the poverty of the general population. How general and indiscriminate fishing ruins fisheries, without any commensurate benefit accruing to the public, I have already stated. In these deteriorated but public fisheries, as soon as the monsoon has set in, and the fry are commencing to move about, women and children are daily engaged in searching for them in every sheltered spot where they have retired for security, as, not being able to face strong currents, or live in deep waters, they naturally resort to the grassy but inundated borders of rivers and tanks. Every device that can be thought of is now called into use; nets which will not permit a mosquito to pass are employed; even the use of cloths may be frequently observed. Neither are the agricultural population idle. They construct traps of wicker-work, baskets, and nets; these traps permit nothing but water to pass, and a fish once inside is unable to return, as they resemble some of our commoner kinds of rat-traps. So soon as fish for the purpose of breeding commence passing up the small watercourses at the sides of rivers and streams, these implements of capture come into use; breeding fish are taken, and the few which surmount the obstructions find the traps reversed, so that, although they have ascended in safety, it is by no means improbable that their return to the river will yet be cut off. In Burmah a large triangular-shaped basket is employed in places where trapping is difficult, and a pair of buffaloes having been harnessed to it, such is dragged through the localities inhabited by the fry. Even when there are no restrictions, fishermen often find it advantageous to ply their occupation in concert. Sometimes large bodies of villagers proceed at

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certain seasons of the year to rivers which can be easily bunded, having done which, they kill every fish they are able.

In investigating what is the minimum size of the meshes of the nets in general use in India and Burmah (excluding Sind), where no regulations exist declaring what such should be, I received the following replies from ninety-one native officials, who refer to such in inches :—

Native officials.	Size in inches between knot and knot of meshes.
5	1 inch.
5	Below 1 inch.
18	½ inch.
5	⅓ "
24	¼ "
1	⅕ "
5	⅙ "
18	⅛ "
4	1/10 "
2	1/12 "
3	1/16 "
1	1/32 "

And out of seventy more returns, fifty-three officials compared the size of the mesh to a grain of wheat, mothi, mucca, gram, dholl, lamp-oil seed, barley, tamarind seed, a small pea, a peppercorn, a large needle, a bodkin, quill, coarse muslin, will ensnare a gnat, or hardly anything will pass. The remaining seventeen described the smallest size as follows :—Size of finger or thumb, five ; of half ring-finger, two ; as big as a broomstick, one ; size of half rupee, one ; of a four-anna bit, one ; of a quarter of an anna, one ; of a two-anna bit, five ; of a pie, one.

The size of the mesh must to a certain extent be made to suit the water to be fished and the fishes to be captured ; thus very small meshes are unsuited for rapids. The figures

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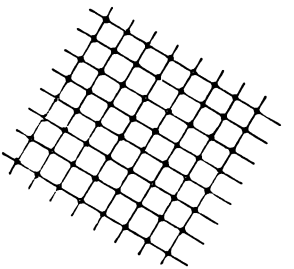
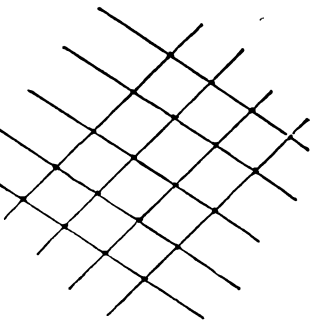


No. 1.



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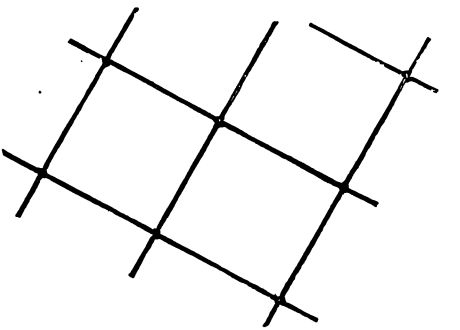

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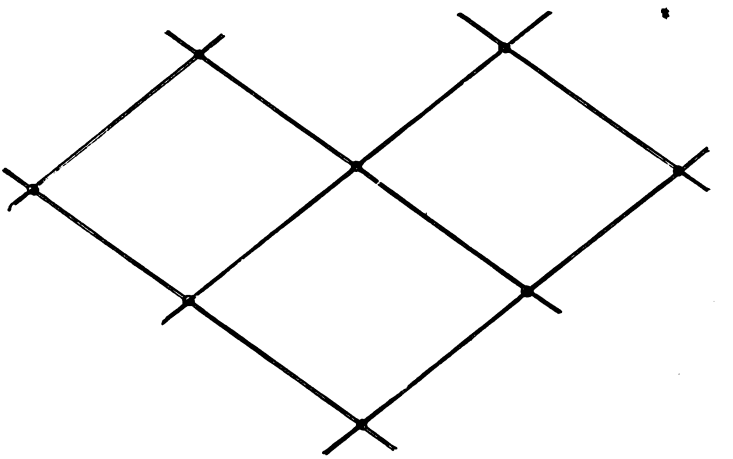

No. 4.

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here given show (1) the size of the mesh in a drag-net employed during the rains in Orissa. As the water subsides and the fishermen are able to wade up to their waists, the size of the mesh is increased (No. 2); and as the waters begin to clear, No. 3 comes into use; and in the cold months No. 4. Young fry commence moving about at the first freshes.

The fixed engines employed in India and Burmah (see Plate I.) are mainly divisible into two forms—(1) those manufactured of cotton, hemp, aloe fibre, coir, or some such material; and (2) others constructed of split bamboo, rattan, reed, grass, or some more or less inelastic substance. Those which are manufactured of elastic substances include all stake-nets, but when the meshes are of a fair size, they are a legitimate means, when properly employed, for the capture of fish, but are occasionally to be deprecated, especially when used solely to take such as are breeding. But in some of these implements the size of the mesh is so minute that no fish are able to pass. There it stands, immovably fixed across an entire waterway, capturing everything, the water being literally strained through it. In one instance, in the Punjab, a whole drove of mahaseer were observed to be captured by natives fixing a net across a river, and then dragging another down to it, thus occasioning wholesale destruction, and ruining the rod-fishing for the succeeding season. This plan is a very common procedure throughout India, as is also constructing earthen dams across streams, leaving a channel or opening through their centre, where a purse-net is fixed, and arrests every descending fish. The largest numbers are taken towards the end of the rainy season, for as the waters fall, countless lakes and pools of all sizes are formed on the low lands in the vicinity of rivers. These, which during the floods were lateral extensions of the stream, now become lakes, having one or more narrow out-

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lets into the river; across each opening nets are stretched, or a weir of grass constructed, and every fish which has wandered up becomes a certain prey to the fishermen.

Fixed engines constructed of non-elastic substances are still more destructive to fish than are such as are made of net, and which are more liable to be injured. Their forms are exceedingly numerous, their sizes infinite, while the interstices, between the substances of which the weirs or traps are composed, appear everywhere much the same, whether examined in the ghâts of Canara, the Yomas of Pegu, the Himalayas, or on the plains of India or Burmah. Still, local influences must occasion certain modifications, while some are solely employed for taking large fish, others for fry, and a few are employed for both. In hilly districts, as the monsoon floods subside, and the impetuosity of the mountain torrents has decreased, they can be erected without being liable to be washed away. Up the hill streams (as I have already observed), some of the most valuable of the carps ascend to breed, but now there are but few that are not weired, and the parent fishes have the greatest difficulty in reaching their spawning grounds. Some, however, surmount the obstacles which oppose their ascent, a few deposit their spawn; this completed, the rains are now passing off, the force of the current lessening; and these parent fish commence descending, trying to regain their low country rivers. I omit in this place how spearing, snatching, or snagging, netting, and angling are carried on, only referring to how fixed engines are employed. Weirs are now erected every few miles, through which the waters of the hill streams are literally strained, while each is fitted with a cruive or fishing-trap. The probabilities are that the great majority of the mahaseer which reach the rivers of the plains are the last year's fry that have fortunately

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escaped destruction during the dry months, and with the first floods have obtained a free passage, due to the standing weirs having been swept away. Wicker traps are likewise constructed across convenient rapids; here few fish can pass without entering, while these are examined twice daily. Or should there be no rapids, such are artificially formed by laying large stones in a V shape across a stream, while at the apex of this a trap is fixed. Or a mountain stream is conducted down a slope over a large concave basket, so that all descending fish are pitched into it, and speedily suffocated by the rushing water or other falling fish, which act like a succession of blows, preventing their ever rising again. Hill streams in some places, as in the Doon, are frequently diverted for the purpose of taking the fish. From March to the commencement of the rains, streams are dammed and turned. In these mountain districts the torrents, where they burst from the hills, form three or four beds, all of which are full during the rains, but subsequently only one. One year one of these beds will be used, another year another bed, and so on. The poachers select a spot where the stream and an old bed are in close proximity: both have good pools in their course. They fix their nets across the stream about a mile, or even more, below the selected spot, first nets with large, and subsequently those with small meshes. These nets are kept to the bottom by means of heavy stones. When the nets are ready they dam up the stream and open a water-way into the old bed. The force of the water soon cuts a deep channel for itself, and thus the late bed of the river is left dry except in the deep holes, while all fish attempting to come down stream are stopped by the net. Large fish are carried off, the fry are left to die as the pools dry up. This process is repeated lower down the

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stream, and after a month or so they begin again at the top of the hillside as before.

In addition to the larger weirs and traps, there are minor sorts most extensively employed, especially in the plains—some to capture breeding fish ascending up the smaller watercourses during the rain to deposit their spawn, others to arrest them and their fry attempting to descend the stream as the flood waters recede; and there is not a district, except perhaps in Sind, where this mode of capture is not carried on. And some officials now speak of the use of these contrivances as communal and prescriptive rights, and hold that their prohibition would be an interference with private property.

Moveable fishing implements are of two varieties, (1) those manufactured of cotton, hemp, aloe-fibre, coir, or of some such material, and (2) others made of split bamboo, rattan, reed, grass, or other more or less inelastic substances. Large drag-nets (see Plates III. and IV.), having fairly-sized meshes, are used mostly during the dry months, and employed for the purpose of obtaining fish from pools in rivers into which they have retired awaiting the next year's floods. But the moveable nets which occasion the most damage are those with small meshes, and principally employed for taking the fry of the fish as they are first moving about; they may be cast-nets with fine meshes, wall-nets dragged up some small watercourses, purse-nets similarly used, and even sheets may be thus employed. In some places several cast-nets are joined together, to stop up all passage of fish along a stream, while others are employed above this obstacle; or several fishermen surround a pool, each armed with a cast-net, and these they throw altogether, giving the fish but little chance of escaping. In Sind the fishermen float down the Indus, in certain suitable localities, upon

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a gourd or hollow earthen pot, while the net is let down beneath them; as a hilsa fish (*Clupea ilisha*) ascends up the muddy and rapid stream, it strikes against the dependent net, which is made to contract like a purse by means of a string that the fisherman holds in his hand.

Irrespective of the modes already detailed as in common use for capturing fresh-water fish in India and Burmah, there are a number of what may be termed minor plans likewise in force (see Plate IV.). Sheets have already been remarked upon as employed for taking the fry which have ascended small watercourses, or are found in shallow water, while they may also be used as dip-nets, being sunk in an appropriate place, and raised by strings attached to the four corners, as soon as the little fish have been enticed above. Or on the sheets bushes may be placed; here the fry seek shelter from the rays of the sun, and the whole concern is lifted bodily up. A little grain or bread is likewise found useful as a bait. Two pieces of rattan may be employed, crossing one another in the middle, where they are tied together: the ends are then bent downwards in the form of two arches. Here a net is attached, and this the fisherman presses down upon the fish, which are then removed by the hand. In some places they may absolutely be so frightened as to permit themselves being readily taken; thus ropes to which at intervals are attached bones, leaves, stalks of kurbi or jowaree, or pieces of solar (pith) or small bundles of grass, are stretched across a stream; two persons, one at either end, constantly jerk this rope, causing the fish to dart away towards nets that are fixed to entrap them. Snares of the most varied descriptions are almost universally employed; but in some localities angling may be said to be almost unknown, especially in Orissa, or districts where wholesale poaching is preferred as easier

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and more successful. One method of using hooks is perhaps as cruel as could well be devised. A number are securely fixed to a line at regular intervals of about three inches for employment in a narrow pass in a hill stream. When used, the rope is sunk from eighteen inches to two feet below the surface, and held by a man on either bank; others drive the fish towards this armed cord, and as they pass over it, the line is jerked for the purpose of hooking it. In some places dexterity has been arrived at by constant practice, and many fish are thus captured. The desire is to hook the game by its under surface; but, as might be supposed, although in some cases the hooks penetrate sufficiently deep to obtain a secure hold, such is by no means invariably the case. The struggles of the wounded creature frequently are sufficient to allow it to break away, often with a portion of its intestines trailing behind it. If its gill-covers have been injured, respiration may be wholly or partially impeded: crippled, it wanders away to sicken and die in an emaciated state: while, should it be captured before death has stopped its sufferings, it is useless as food, unless to the lower animals. Baited hooks are in some places fastened to lines, which are tied to bamboos fixed in the beds of rivers, or to bushes or posts at their edges, and so managed that when a fish is hooked the line runs out. Or a somewhat similar plan is to have a cord stretched across a river, floated by gourds; to this the short lines which have the baited hooks are attached, but so that they are not long enough to reach the bottom; these are visited every few hours. In some districts night-lines are baited with frogs. Spearing fish by torchlight is extensively practised in the Punjab and in the Presidency of Bombay; or they may be speared during the daytime in the cold months of the year, when they are

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not very active. Two persons usually engage in this occupation; the one punts the boat along as noiselessly as possible, while the fisherman stands at the prow, silently pointing to the direction to be adopted, and uses his spear when he gets a chance. Shooting fish with guns is carried on in Oude, and occasionally elsewhere. This is more especially employed for the snake-headed walking-fishes (*Ophiocephalidæ*), which are frequently seen floating on the surface of the water, as if asleep. They may be approached very closely, but the game usually sinks when killed, and has to be dived for, or otherwise obtained. Crossbows are also employed for a similar purpose in Malabar. In Mysore—observed the native officials of the Nagar division—fish are taken by nets, traps, hooks, cloths, by the hand, by baskets of different shapes, by damming and draining off the water, by shooting, by striking them with clubs, with swords, or with choppers, by weirs, and by various descriptions of fixed engines; in short, by poaching practices of every kind, as well as by fishing with rods and lines, and poisoning pools of water by milk bush, tobacco-leaves, Indian hemp, and many poisonous kinds of jungle fruits. This is generally carried on during the dry seasons of the year, when the pools in the rivers are still, and hardly any current exists. It is very easy to collect the poisons, throw them into a pool, and await the fish floating intoxicated to the surface. These fish are sold in the markets. Even fishes' eggs do not escape the general hunt to which the persecuted finny tribes are subjected in these days, the ova being collected and made into cakes, which are considered a delicacy.

The boats employed for fishing purposes (see Plate II.) are too numerous and varied to permit of description in this place. The dug-out, or boat of a solid tree, is common. The

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coracle is also known; while the fast-sailing fishing-boats of the Konkan, termed Muchvas (an excellent model of which is in the Fish Exhibition), are evidently improvements on the dug-outs of the Maldives. One curious boat from Chittagong, but which is also employed throughout Burmah and the East, is fitted up with a bamboo platform on one side, behind which a bamboo, having palm-leaves attached, projects into the water. Thus fish are scared, and spring on to the platform, which is partly submerged, and on into the boat, while a net fixed on the opposite gunwale precludes their clearing the boat.

There are certain vermin in the East which are destructive to fish, some when in the immature, others when in their matured state. Commencing with the crocodiles, two distinct genera have representatives in the waters of India. The true fish-eating crocodile (*Gavialis gangeticus*), with its long and slender snout, attains upwards of twenty feet in length, and is a resident throughout the main courses and affluents of the Indus, Ganges, Brahmapootra, and Mahanuddi rivers, but absent from Burmah, and most of those in Bombay and Madras. This species is usually timid of man, excepting when he invades the locality where it has deposited its eggs. Their diet appears to mainly consist of fish, turtles, and tortoises. In 1868, I found it was one of the sights of Cuttack to watch these enormous reptiles feeding in the river below the irrigation weir which impedes the upward ascent of breeding fish. The long brown snout of the crocodile would be seen rising to the surface of the water, holding a fish crosswise between its jaws; next, the finny prey was flung upwards, when, descending head foremost, it fell conveniently into the captor's comparatively small mouth.

Crocodiles, similarly to predaceous fishes, generally

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swallow the finny tribes head first, because, if they are of the spiny-rayed forms, their spines are thus pushed backwards, lie flat, and do not injure the creature which is swallowing them. Were they taken in tail first, this would erect the spines, and wound every animal which should endeavour to swallow them. Doubtless some forms, while in transit, wriggle themselves round, and get fixed in the gullet of their captors, as the father-lasher of our coasts. These reptiles are very prolific. Thus the overseer in charge of the Narrage weir in Orissa, in the year 1869, came across a brood, and within three hours shot sixty-nine. When at this place I obtained a young one that had become entangled by its teeth in a fishing net, and asked the fishermen if they ever destroyed them. Astonishment was depicted on their faces, and they protested against the supposition that they had ever been guilty of such a mean action. Their argument was that both classes belonged to the fish-destroying races, therefore on the principle that hawks do not pick out hawks' eyes, they consider it would be wrong to cause their deaths. As to the destruction they occasioned, they admitted it, but also observed that they would do as much if they were able. It must not therefore be hoped that fishermen will assist in clearing rivers of these monsters; neither will the native sportsman throw away a single charge of powder and ball on such unremunerative game, which he could not sell, and would be unable to eat.

The common crocodile, *Crocodilus palustris* and *C. porosus*, are found in most parts of India and Burmah. These reptiles, although often termed man-eaters or snub-nosed crocodiles, assist in depopulating the waters of fish, and it has appeared to me that it is mostly when they find an insufficiency in the finny supply and carrion that they

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turn their attention to man and the larger mammals. Every traveller in the East must have seen these logs of wood, as they appear to be, lying for hours at the sides of rivers or on rocks above the surface of the stream, and which sink so noiselessly into the current as almost to make one believe one's eyes had been deceptive, for how could anything so large have so quietly disappeared. In 1868, when at Cuttack, the crocodiles' appetites were not appeased by the fish they obtained, so they commenced consuming human beings, horses, and cows, varying their diet with an occasional goat or sheep. Doubtless, in large rivers, as the Ganges, these reptiles have their redeeming qualities, being the natural scavengers and consumers of carrion. Human beings are now no longer permitted to piously place their dying relatives by the side of the sacred stream, fill their mouths with mud, and leave them to be carried away by the waters or adjacent crocodiles; neither are corpses interred in the current of that holy river. If fish are insufficient, and the crocodiles are not to be destroyed, from whence are these reptiles to obtain their subsistence? The common law of self-preservation will induce them to feed on the cattle of the neighbouring country, or on such human beings as unwarily approach too near to the waters in which they reside. This is no fancy sketch, but I will merely adduce two instances that came under my notice in 1868. At Cullara exists a hole or pool in the Nuna River to which these monsters resort during the dry season, and a short time prior to my visit, they had succeeded in carrying off five adult human beings, while near the Baropa weir two women and one horse were taken by crocodiles in a single month.

Otters are likewise very destructive, especially in the hilly districts, and when they have exhausted the fish, they

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turn their attention to the frogs. In fact, the large frogs (*Rana tigrina*) are evidently considered great delicacies by these animals, for when kept domesticated they even seem to prefer them to fish. In some rivers, as the Ganges and Indus, the porpoise (*Platanista*) is a large fish consumer.

When mentioning animals which compete with man in destroying fishes, there are some families that must not be omitted, although I only propose casually to allude to them. Birds which eat fish are exceedingly numerous, not only in the true swimming and wading forms, but even the Indian pee-wit may be observed in the dry months taking its share of the smaller examples of the finny tribe that are more or less exposed to view in the drying-up pools. Snakes luxuriate in irrigation canals, and revel in luxury at the bases of the larger weirs. In that across the Coleroon, when the water was low, I was plainly able to see these reptiles lying in wait for the fishes attempting to ascend. I should suppose I never saw less than twenty any evening I examined this weir on its down-stream face. Tortoises and turtles are fish-consumers, while most fishes prey upon their weaker neighbours or their eggs. Near Ganjam, a native official informed me how he had ventured out one night to see how murrul—the walking-fishes—were captured. The fisherman was provided with a long flexible bamboo as a rod, and as a bait used a live frog. Hardly had the frog splashed into the water, when a moderately-sized murrul seized and swallowed it. Desirous of observing what would next occur, the fish was left on the hook, as a bait for anything else. Before long, a large water-snake was seen swimming towards it, and soon had the fish enclosed in its capacious jaws, and in this fashion all three were pulled together out of the water. Frogs

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appear to relish fish-eggs, and to be by no means averse to occasionally devouring the fry.

Considerable discussion occurred respecting the condition of the fresh-water fisheries in India, some high officials suggesting that a falling-off in the quantity is no reason for legislative interference, unless it could be demonstrated that a danger existed of annihilation. The Viceroy summed up the question in the following suggestive sentences :—"Is the present plan of non-interference likely to ensure to future generations the fullest possible supply of this food staple? Is it even such as to ensure their inheriting a supply equal to that which now exists? The Governor-General in Council apprehends that both these questions must be answered in the negative, and that not only is there no prospect, as matters now stand, of an increased supply hereafter, but that, owing to the absence of precautionary measures and reasonable restrictions, the existing supply is diminishing."

Were poisoning of the fresh-water forms to be prohibited, the sale of fry be rendered illegal, and traps and nets placed under control, an immense increase in the amount of the fresh-water fish would be a certain result. Here I must refer to an experiment which has been made in India for the purpose of protecting fisheries. If no destructive waste was existing prior to the commencement of protective measures, no augmentation of the fish would have become apparent; if, however, very beneficial results have ensued, there does not appear any reason why such should not be extended elsewhere. In South Canara, Mr. H. S. Thomas observed that it may be doubted whether poisoning rivers or the wholesale destruction of fry is most injurious to fisheries; while prohibiting the finer and closely-woven bamboo cruives has been that the most ignorant, and therefore the most obstinate opponents, have been convinced by

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the testimony of their own senses, and have exclaimed, to use their own words, "truly the river is everywhere bubbling with fry;" and, what is still more to the point, their practice has not belied their words, for they have taken to fishing on grounds that were before considered profitless. Two years' discouragement of poisoning, and one year's discouragement of fine cruives, has worked such a change that it has been demonstrated, beyond cavil even of the ignorant and of the most interestedly opposing, that marked advantage can be reaped from the adoption of these two simple measures alone.

What rules have been instituted in order to mitigate the condition of the fisheries I have been unable to ascertain. An Act (VII. of 1875), however, has been passed for Burmah, for the protection of the fisheries; while Mr. Buckland, Member of the Revenue Board in Calcutta, remarked (November, 1879) that the following figures show the progress which is being gradually made at Goalundo, at the confluence of the Ganges, and Burhampootra, where hilsa fish abound:—Fish cured 1875, 1,362 maunds; 1876, 4,835; 1877, 10,800; 1878,* 14,000. He concludes that "there is, therefore, some reason to hope that Dr. Day's proposal may bring some good fruit after a while." While at page 6 I have referred to some results obtained in Madras.

I now propose considering what proportion of the people of India and Burmah use fish as food, or, rather, can do so without infringing caste prejudices?

In the Punjab, comparatively but few of the inhabitants are prohibited by their religion from consuming fish, but

* This shows an increase of 1,043,215 lbs. of fish in a year in one locality, where in the first of the four years nearly 112,073 lbs. only were prepared.

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there are many Hindus who reject it, as well as the rural population of some districts. But of those residing in towns, and in hilly ranges, it appears that, if the Brahmans are excepted, the consumption of fish is only limited by the paucity of the supply and the cost of the article. In Sind, fish is generally eaten by the population of the province, whether Mussalman or Hindu, unless a Brahman. In the North-West Provinces, containing about 28,000,000 of population, out of twenty returns received from native officials, seventeen give more than half of the people as not forbidden by religious scruples from eating fish. In Oudh, the majority of the people appear to eat fish, but the supply is unequal to the demand. In the Bombay Presidency, the majority of the inhabitants of the inland districts are consumers of fish when they can procure it. In Haiderabad, Mysore, and Coorg, more than half the population are fish consumers; in South Canara, 89 per cent.; in Madras the majority, the exceptions being Brahmans, goldsmiths, high-caste Sudras, the followers of Siva, Jains, &c. In Orissa, more than half the people; in Bengal proper, from 90 to 95 per cent.; in Assam and Chittagong, almost the entire population; and in Burmah, in the form of *nga pee*, its use is universal.

As Buddhists, the Burmans profess a religious horror at taking the lives of lower animals, but being immoderately fond of fish diet, they console their consciences (while indulging in it) with the idea that the deaths of those animals used by them as food must be laid to the account of the fishermen, and cannot in any way be attributed to the consumers' fault. The walls of their temples have pictures of the terrible tortures the fishermen will have to endure in a future state of existence. In some of these interesting representations are large fires being stirred up by

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devils, while other evil spirits are dragging more fishermen in nets towards the burning fiery furnace, helping on some by striking fish spears into them from behind, and hauling them forward by hooks and lines fixed to their mouths towards the place of punishment.

But it may be asked are these Poongees' (priests) practices in accord with their teachings? By no means, as the following example will show. At Yahdown, on the banks of a branch of the Irrawaddi, a fisherman (Een Thoogyee), built a *Kyoung*, or monastery, as his great hope was to be termed a *Kyoung taga*, or founder of a monastery, a highly-prized title amongst the Burmese. Poongees came, and Poongees went away, but they did not care to remain, and partake for any lengthened period of the hospitalities of their host and disciple. At last one old priest appeared, who seemed to consider the quarters as desirable. To him, in great trepidation, the owner put the following question, "Why, my father, do not the Poongees approve of my monastery, for none but yourself have remained over the going down of two suns?" "Because, my son," replied the holy man, "do you not break the law by depriving the fish of life?" "True," he answered, "but were I not to do so, how could I supply your table with fish, or how could I live were I to give up my employment?" The only reply he could obtain was, "Better to fast while keeping the law, than to feast whilst breaking it!"

With sorrow the disciple took the priest at his word, and for three days refrained from fishing, giving his preceptor merely vegetables for his diet. On the fourth morning, when the same fare appeared, the Poongee observed, "My son, when you fish the river, does your net extend all across, permitting no fish to escape; or is a portion of the river free for those which select to pass to one side?" "Not all

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across, but only one-third of the way," he answered. "Well, then, my son," said the priest, "I have been seriously considering the subject, and have arrived at the conclusion that, if you leave room for the fish to ascend or descend the stream, and they will not avail themselves of it, but rush headlong into your net, the fault is theirs and not yours. Even Gaudama blessed the hunter who met him when he was hungry, and supplied him with venison. This was accounted as a meritorious act, although he must have killed a deer to obtain it. So go, my son, and procure me some fish, for I am hungry." From that day the priest consumed his fish in quietness, and refrained from inquiring from whence it had been procured.

Investigating how the local markets were supplied with fish up to 1873, the replies from native officials gave the following results. In the Punjab one in ten markets was sufficiently supplied, in the North-West Provinces one in three, in Oudh one in four. In Bombay the amount was stated to be insufficient in all, and the same reports came from Haiderabad, Mysore, and Coorg. In Madras, near the sea, the quantity of fish was sufficient, but only in one in ten of the inland markets. In short, merely one-tenth of the bazaars were reported as fully supplied with fish, and of these one-fifth obtained them from the sea-coast.

Fisheries, to a more or less extent, exist in the Indian Ocean, as well as up to the mouths of the larger rivers, in backwaters and estuaries; while parallel to certain places, especially along the coasts of the Madras Presidency, vast mud-banks are present in the sea, having such a thin consistence that many kinds of fish are able to obtain abundance of food there as well as a suitable locality in which to deposit their ova. The most casual observer cannot fail to perceive how numerous are the varieties and vast the

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number of the finny tribes in the seas of India, but from some cause—whether due to the legislative enactments and local obstructions, or native apathy and impecuniosity—the harvest has, up to within the last few years, been comparatively untouched; an enormous amount of food still remains uncaptured, while famines are devastating the contiguous shores.

FRANCIS DAY.

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EXPLANATION OF PLATE I.

1. *Dollika.*—A trap made of split bamboos, used in shallow water It is plunged suddenly into the water. From the Godavery.

2. *Honcha.*—A fishing scoop. From Nuddea.

3. *Malai.*—A fishing trap set in stone weirs, with the large end down stream.

4. *Ghonee.*—A trap with a double screen of finely split bamboos. From Bengal.

4*a*. Section of above.

5. *Khora.*—A trap used in irrigated fields, for catching fry in channels where there is no current. From Bengal.

6. *Aineh.*—Is set in streams frequented by small fish. From Bengal.

7. *Dhaur.*—A Λ-shaped trap, with a loose screen of pointed bamboos. From Bengal.

8. *Hoochna.*—Trap for catching fry.

9. *Dhowree.*—A trap used in shallow streams. From Cuttack.

10. *Doob.*—Small trumpet-shaped trap, with narrow orifice, let into a short cylinder. The cylinder is taken off in order to remove the fish.

11. *Koramenalu Vuchii.*—A trap of net-work placed amongst rushes in tanks for murrel (*Ophiocephalus marulius*). From Godavery.

12. A vase-shaped basket, with small opening, for carrying fish.

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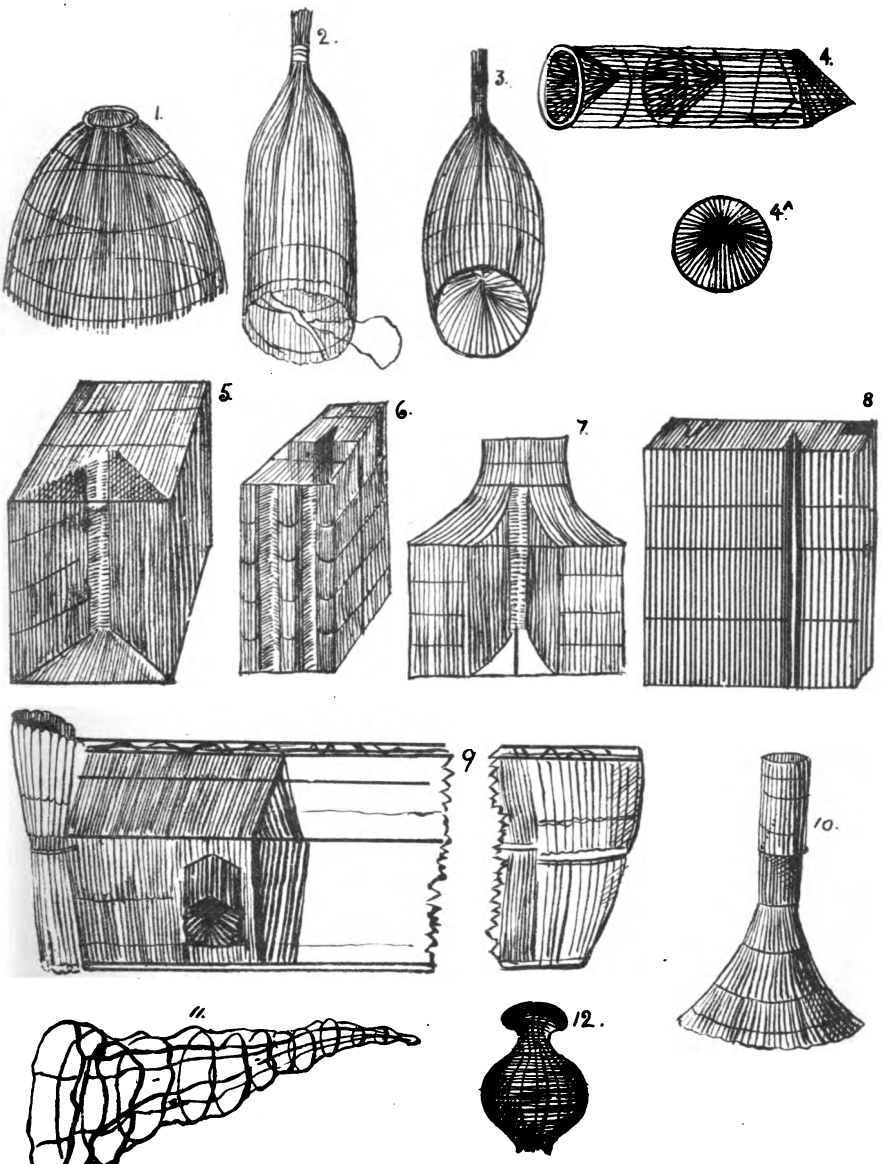
PLATE.I



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EXPLANATION OF PLATE II.

13. Fishing-boat, fitted with a bamboo platform projecting into the water on one side, and with a net placed obliquely on the other. The fish are frightened on to the bamboos, and in leaping into the boat are prevented from clearing the other side by the net.

14. *Parachal.*—A coracle, or flat-bottomed boat, used in rocky torrents in the Bowani river, Coimbatore.

15. Bombay fishing-boat (Muchwa), built of Malabar teak.

16. Canoe dug-out, or *donga*, made of the stem of *Borassus flabelliformis* or *tār* palm; the soft portion of the palm-stem is excavated, and the broadly expanding base forms the prow.

17. Head of paddle belonging to the Muchwa.

18. Anchor made of wood, and weighted with stone or brick.

19. Bombay fishing-boat (Tony), made of Malabar teak.

20.
20*a*. } Madras Masulah boat: the planks are sewn together.
20*b*.

21. Fishing-vessel from Tuticorin.

22. Burmese snake-boat, for passengers.

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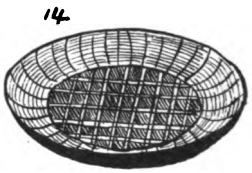
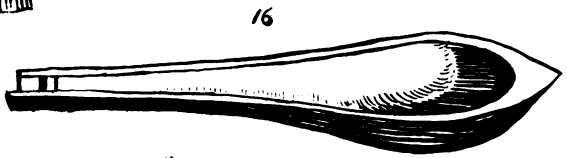
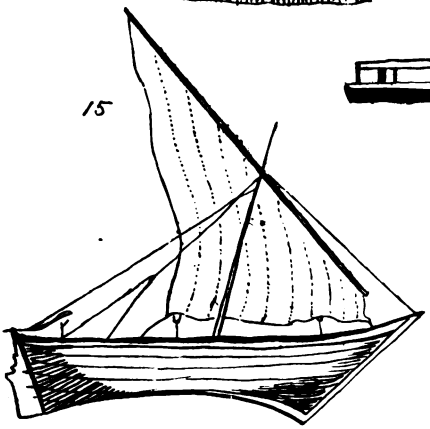
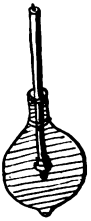
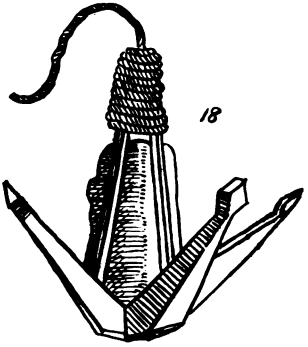
PLATE. 2

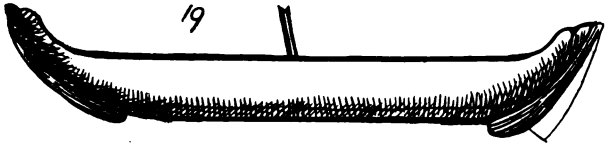


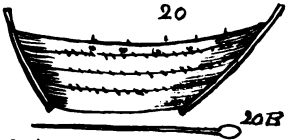


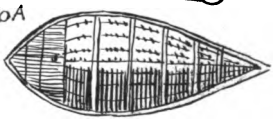


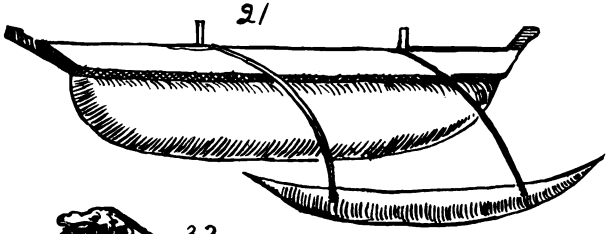












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EXPLANATION OF PLATE III.

23. }
24. } Casting-nets.

25. A landing-net from Moorshedabad.

26. *Choba.*—A plunge-net, used chiefly in shallow water to capture fish which lay half-concealed in the mud. From Poona.

27. A shrimping-net. From Poona.

28. *Yethuvala.*—A hand-net. From the Godavery.

29. *Akhu.*—A scoop-like net for catching small fish. From the Konkan.

30. Stake-net—can be raised or lowered according to the depth of the stream.

31. *Palona jal.*—The base forms a scraper to which the net is permanently attached, and which has sockets for the receipt of the side bamboos. From Cuttack.

32. *Mai jal.*—A drag-net, attached to a bow-like bamboo, having a weight fastened to each end and a cord fastened to the middle. It is dragged along the bottom like a dredge.

33. *Chach jal.*—A hoop supporting a bag-like net 3 ft. in length, with a *septum* about 11 inches from mouth leading into the lower portion of the net. From Chittagong.

34. *Poluha jal.*—A conical net, used by means of a framework of six bamboos tied together at the apex, and kept in position by a hoop. The fisherman climbs on to this framework, and if in shallow water stands on the hoop, he then loosens the cord by which the net is fastened to the bamboos, and the net falls to the bottom. A feeler (which may be the rudder of his boat) to ascertain whether any fish are under the net, and if he finds one the spear is used.

35. A dip-net, with weights.

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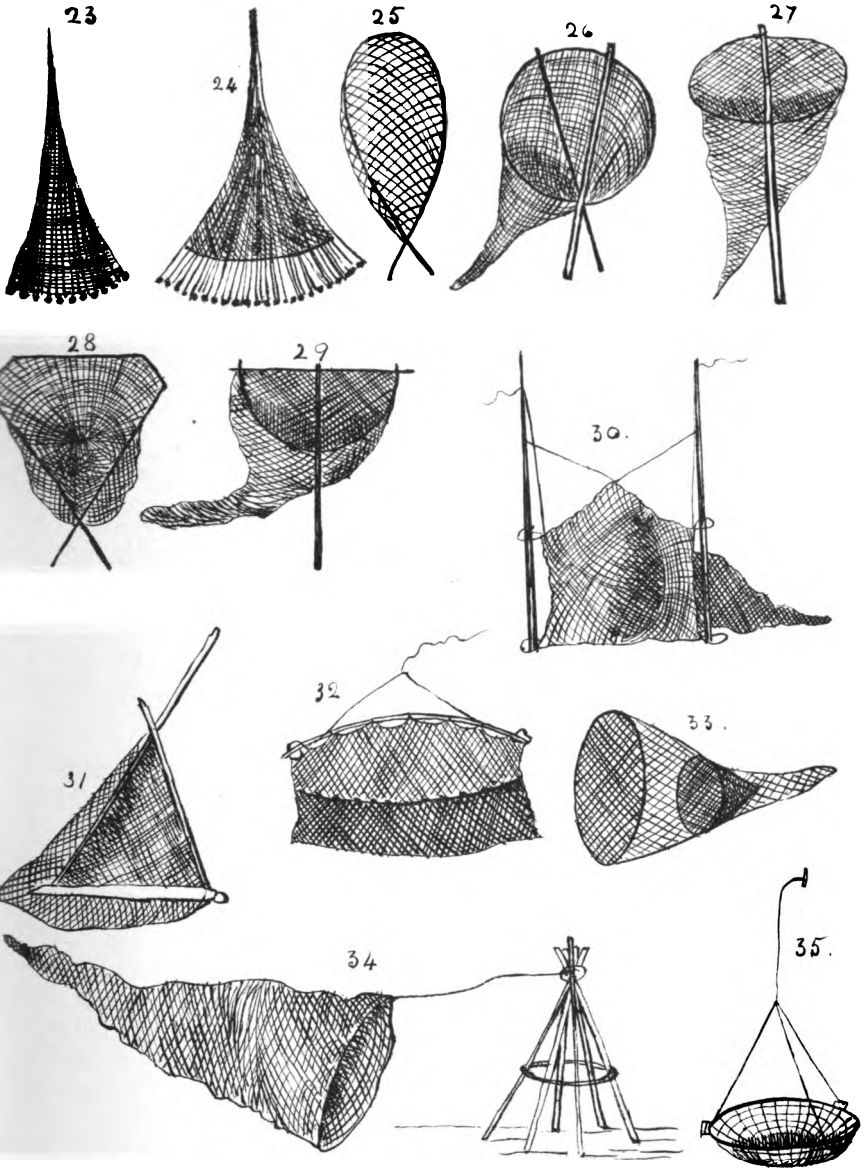
PLATE. 3



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EXPLANATON OF PLATE IV.

36. *Kharo jal.*—A large dip-net worked by means of a complicated arrangement of bamboos and a boat. To raise or cover the net, which is supported by a bamboo fixed to the side of the boat, a man steps backwards or forwards on the lower of the two bamboos which join the tripod of bamboos on the shore to the upright bamboos on either side of the boat. With one hand he holds on to the upper bamboo, and with the other raises or dips the net by means of a string attached to the bamboo which is fixed into the side of the boat.

37. Artificial bait in use among the Divi Islanders.

38. Malabar puffing tube, with darts used for killing fish.

39–46. Various kinds of spears used for killing fish, turtles, or tortoises.

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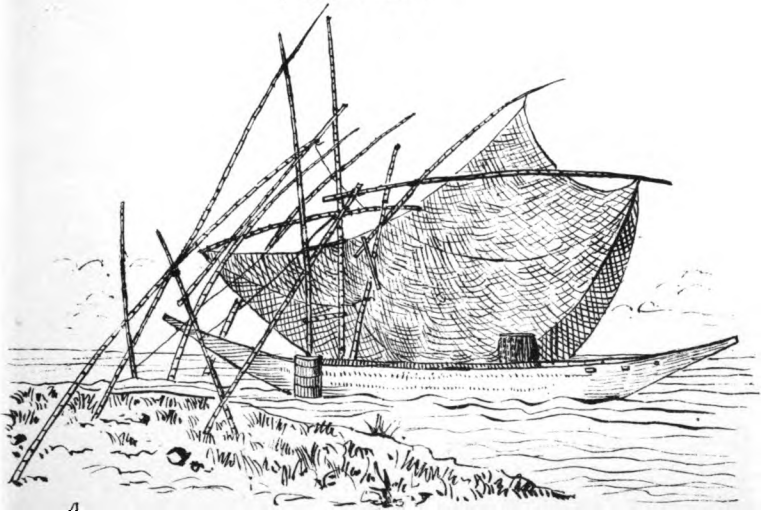
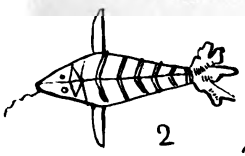
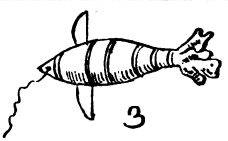
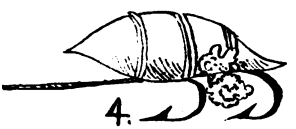
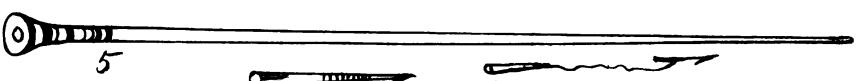
PLATE. 4

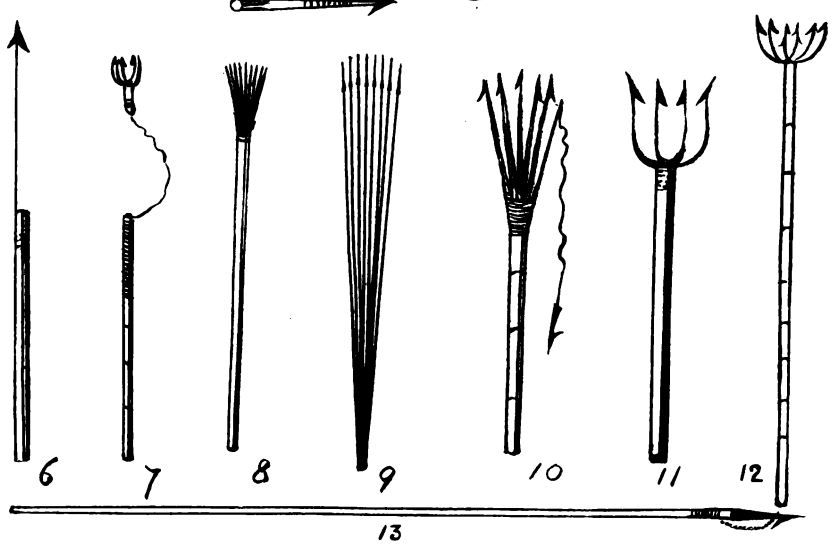












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